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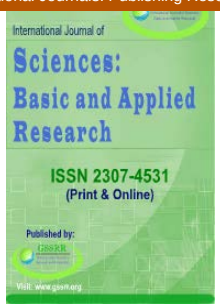

The Profile of Riparian Tree Grown in the Area of Water Springs in Kupang, *Nusa Tenggara Timur* Province Indonesia

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Abstract

This study aimsat determining the profile of riparian trees in springs located in Belo and Labat somewhere around Kupang city Indonesia. This is a descriptive study applyinga systematic random sampling method. The results show that both, naturlaness and hemeroby of spring in Belo show the same index that is 4, while in Labat were respectively 3 and 5. This is clearly seen that the index of species richness in Belo was higher (3.1) than that in Labat (1.6).However, the diversity index of riparian tree in Belo (1.83) and Labat (1.45) are categorized as low compared with the diversity index according to Krebs (1985). The composition of riparian tree species insprings located in Belo and Labat were not same or the similarity index (SI)is 42.05%. The riparian tree vegetation has been experiencing degradation due to the influence of high anthropogenic activities.

***Keywords*:** Riparian; Water springs.

1. Introduction

As a consequence of population growth, the need for food, shelter and clothing continues to increase. This condition causes changes in vegetation cover for various activities that can reduce the quality of biodiversity.

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One of those affected is the riparian ecosystem. Riparian is seen as a unique ecosystem because of its location between aquatic ecosystems and terrestrial ecosystems and has a vital role in protecting both ecosystems [20]. Ecological services provided by riparian ecosystems include protection of water quality, temperature control, erosion prevention, habitat, and corridors [18]. In addition, riparian ecosystems also act as filters for nutrients and sediments, as well as a storehouse of biodiversity [3]. One of the biotic components of riparian ecosystems that play an important role that can make ecological services continue to be available is the existence of natural riparian vegetation.

Vegetation of trees most often gets disturbances, especially from humans, whereas the tree vegetations have a key role in the integrity of riparian ecosystem functions. In addition, trees have a strong and deep root system that has the potential to increase the capacity to hold the soil, increase the infiltration rate so that the process of surface runoff and erosion can be minimized [1]. The existence of natural riparian vegetation is a factor that determines the high or low water quality of a water body, especially in springs. Springs as one type of groundwater that appear on the ground surfaces naturally becomes a source of clean water for people living around it. This makes the springs vulnerable to disruption, especially by humans. In addition to rock, soil, and topography factors, the use of land that is not in accordance with geographical conditions such as agriculture in sloping areas, settlements near water catchments, grazing livestock on critical land, etc. will be able to change vegetation quality and water quality. Land use through logging of riparian vegetation has a direct effect on reducing water infiltration into the soil, and increasing surface runoff [18].

This condition can be more serious by the emergence of erosion, sedimentation, waste, invasion of exotic species, and landslides. In the event of rain, the chances of erosion are greater because there is no vegetation that plays a role in slowing the flow of water. Further erosion causes a lot of sediment to accumulate in the downstream of the spring so that water quality decreases [11]. Meanwhile, human activities also increase water pollution because of the waste generated from the application of chemical compounds such as the use of fertilizers, herbicides, weeds, and pesticides, resulting in a decrease in the quality of springs [14].

This research focuses of vegetation of riparian tree as a bio-indicator of water quality. The diversity of riparian tree can be used as biological reference in determining bad or good quality of water spring in Kupang city, particularly in Belo and Labat.

2. Materials and research method

This research is a descriptive qualitative paradigm applying systematic random sampling for a three times doing repetition. Observation was also done prior to doing field research to identify water springs at two different locations, Belo and Labat, around Kupang city, East Nusa Tenggara province in October 2016. Direct observation of the quality of tree vegetation by measuring number of individuals, height, stratification [6], naturalness index [10], and hemeroby index [7]. It is worth noting that if there is specimen of which, the species has not been identified, the specimen will be collected latter. Then its dry herbarium will be made for the identification purpose. The identification was done by browsing internet, books for flora identification with the assistance of technician that has known much about the types of leaves, flowers, and fruits that have been

transformed into dry herbarium.

The data then were analyzed quantitatively. The result of data analysis depicts the profile of riparian tree available around water spring in Belo and Labat. The similarity in the index calculation is presented next.

a) The richness index [2]

The mulberry of R1 < 3,5 shows the richness of types categorized low; while the R1 = R1 = 3,5- 5,0 shows the one categorized as medium (average), and R > 5,0 is categorized high.

$$R1 = \frac{S-1}{ln\, N} \quad (1)$$

Note:

R = Index of species richness

S = Number of species (n_1,n_2,n_3,…)

N = Total number of the whole individuals.

b) Diversity Index[8]

The criteria diversity index is H'= 0 – 2,302 (low diversity), H'= 2,302 – 6,907 (sufficient diversity), and H'= ≥ 6,907 (high diversity).

$$H' = -\Sigma pi\, ln\, pi;\ pi = ni/N \quad (2)$$

Note:

H'= Diversity Index

pi= Proportion of number of individuals of type *to-i* with the total number of all types of individuals

ni= Number of individual of species i

N= Total number of individuals

c) Index of important value (IVI) [15]

$$IVI = KR + FR \quad (3)$$

Note:

IVI = Important Value Index

KR = Relative density

FR = Relative frequency

d) Index of community similarity[5,13]

(4)

$$SI = \frac{C}{A+B+C} x\ 100\%$$

Note:

SI= Index of Sorensen similarity

C= Number of individuals of similar tree species at the statiun A and B

A= Number of individualsof tree species at statiun A

B= Jnumber of individuals of tree species at statiun B

3. Findings and discussion

Riparian tree vegetation habitats growing around springs have been observed in Belo and Labat Kupang, East Nusa Tenggara. The two springs and channels monitored during the study were surrounded by riparian vegetation which had been partially converted, degraded or affected by human activities. Land use conditions also influence riparian vegetation habitat. Land use conditions found include settlements, rice and vegetable farming. This shows that riparian vegetation has been degraded (Figure 1).

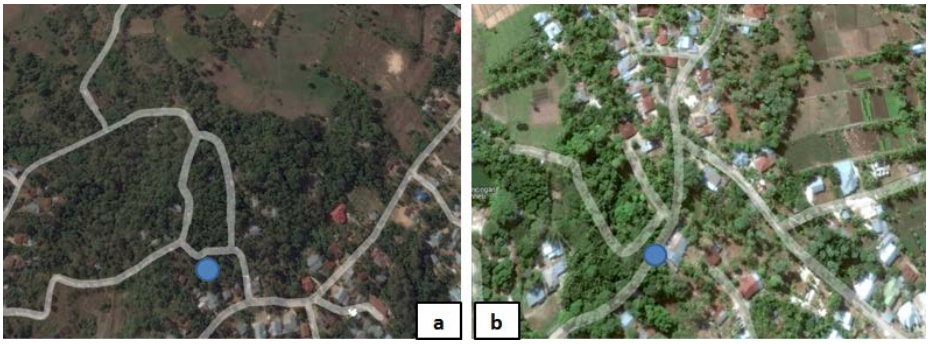

Figure 1: Profile of habitat for degraded riparian tree vegetation: a) Belo; b) Labat.

In assessing the quality of riparian vegetation, the index of quality of vegetation was used including the index of naturalness and hemeroby. Figure 2 shows the index value of the quality of riparian vegetation varies. The value of naturalness in Belo was higher than that in Labat, while the hemeroby value in Labat was higher than that in Belo. Naturalness in Belo reaches 4 (cultural assisted system, forced by humans) and hemeroby 3 (α -

mesohemerobic, moderate disorder). This condition is due to anthropogenic activities in the form of settlements and agriculture, so that many plants are degraded. This is not very different from the vegetation in the spring of Labat. The value of naturalness reached 3 (highly intervened system, very intervened), and the hemeroby value reached 5 (polyhemerobic, very large disturbances). This condition is due to the presence of paved roads and many settlements around the springs. Hemeroby values are contrary to the value of naturalness. The higher the value of naturalness, the lower the hemeroby value is.

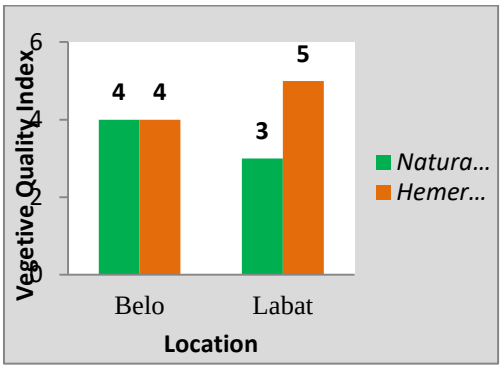

Figure 2: Index of riparian vegetation quality in Belo and Labat

Profile of riparian tree vegetation is illustrated by the richness of riparian tree species, dominance of riparian tree vegetation, riparian tree diversity index, and community similarity index. Riparian tree vegetation structures in the observed locations vary greatly and depend on environmental conditions. The wealth of riparian tree vegetation found in the observation sites was 16 species from 12 families. Riparian species found in these 2 locations include coconut, banyan, palm, acid, and johar (Table 1).

Table 1: Types of riparian trees found in the springs of Belo and Labat

No	Location	Local name	Family	Species
1	Belo & Labat	Kelapa (coconut)	Arecaceae	*Cocos nucifera* L.
2	Belo & Labat	Beringin (banyan)	Moraceae	*Ficus sp.*
3	Belo & Labat	Palem (palm)	Arecaceae	
4	Belo & Labat	Asam (acid/sour)	Fabaceae	*Tamarindus indica*
5	Belo & Labat	Johar (shade tree)	Fabaceae	*Cassia siamea* Lamk.
6	Belo	Jati (teak)	Lamiaceae	*Tectona grandis*
7	Belo	Nangka (jackfruit)	Moraceae	*Artocarpus heterophylla*
8	Belo	Mangga (mango)	Anacardiaceae	*Mangifera indica*
9	Belo	Kom (comm)	Rhamnaceae	*Ziziphus mauritiana* Lam.
10	Belo	Kesambi (kesambi)	Sapindaceae	*Schleichera oleosa* MERR.
11	Belo	Kepok/Randu (kepok)	Malvaceae	*Ceiba pentandra* Gaerth.
12	Belo	Sirsak (soursop)	Annonaceae	*Annona muricata* L.
13	Belo	Pandan Laut (pandanus)	Pandanaceae	*Pandanus tectorius*
14	Labat	Mahoni (mahogany)	Meliaceae	*Swietenia macrophylla*
15	Labat	Ketapang(almond tree)	Terminalia	*Terminalia catappa* L.

Species wealth is the number of species (species) in a community. The more number of species found, the greater the wealth index is. The wealth of riparian trees found in the Belo and Labat springs can be seen in Figure 3. The highest species wealth was found in Belo with values reaching 3.1, and in Labat reaching 1.6. Based on the criteria of Ludwig and Reynolds (1988), the wealth of riparian tree vegetation found in the Belo and Labat springs is low (R1 <3.5).

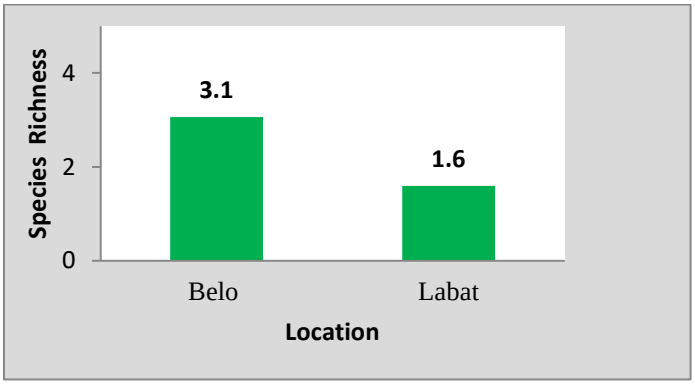

Figure 3: Wealth of riparian tree species found in the springs of Belo and Labat

Important Value Index (IVI) of plant species in a community is one parameter that shows the role of these plant species in the community. The presence of a plant species in an area shows the ability to adapt to habitat and wide tolerance to environmental conditions. The greater the IVI value of a species is, the greater the level of mastery of the community and vice versa [13].The springs in Belo are dominated by coconut or *L. nucifera* L. (62.5%) from the Aracaceeae family, while in Labat it is dominated by the palm of the Aracaceae family (69.59%). Naturally the structure of riparian trees is composed of various taxa, so there is rarely one dominant species [15].

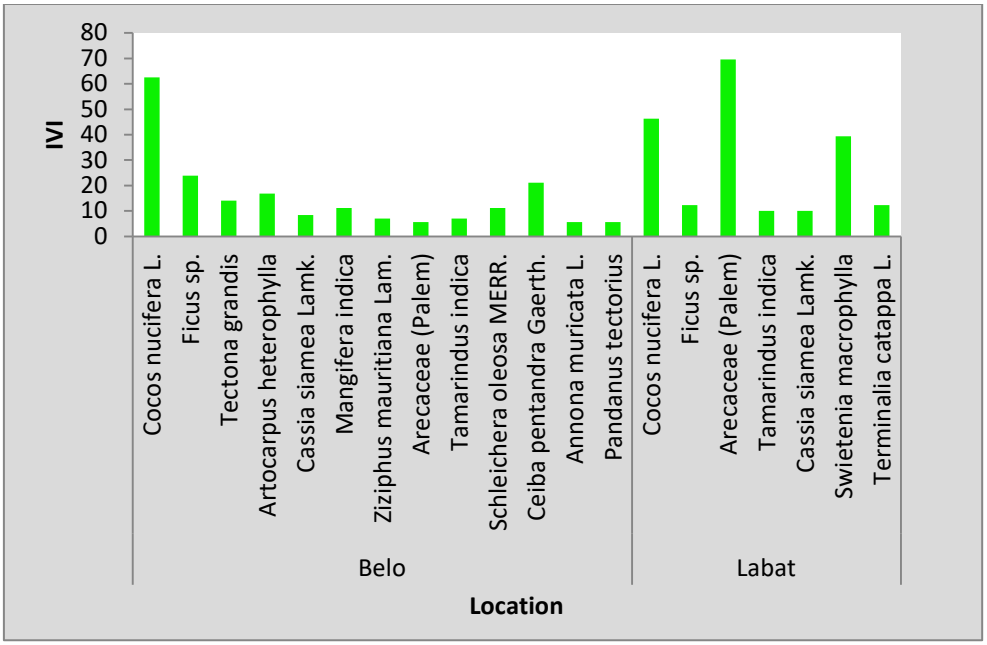

Figure 4: IVI of riparian tree vegetation in the springs of Belo and Labat

Riparian tree vegetation found in the Belo springs and Labat has undergone changes in community structure so that the remaining species are tree species that are deliberately planted or of economic value, such as mangoes, coconuts, jackfruit, and litters. The important value indices are one of the parameters that can provide an overview of the role of the species concerned in their community [19]. Therefore simplification of the structure of riparian vegetation poses a risk of decreasing the role of species in springs.

The diversity of riparian tree vegetation found in the Belo and Labat springs is different (Figure 5). The highest species diversity index found in Belo reached 1.83, while in Labat it reached 1.45. The diversity index is relatively low (0 – 2.302). This shows that riparian tree vegetation has been degraded, which is in line with the research of Singh and his colleagues (2005) who found diversity indices for degraded tree vegetation in Indian tropical forests reached 1.99.

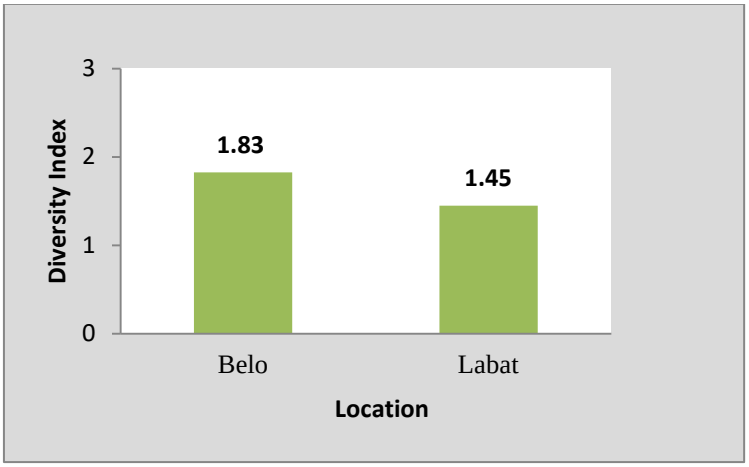

Figure 5: Shannon-Wienner diversity index riparian tree vegetation in Belo and Labat

The calculation of the Sorensen index to find out the similar composition of riparian tree species in the springs of in Belo and Labat obtained a value of 42.05% (Table 2). Similarity index values range from 0-100%, where the higher the species similarity index value shows the higher the level of similarity between the two communities compared [12].

Table 2: Percentage of value of community similarity between Belo and Labat

Location	SimilarityIndex (SI)
Belo dan Labat	42.05 %

The similarity index of species composition between 80-100% is considered to be of similar vegetation conditions, while 50-80% is different, and less than 50% is significantly different [4].

The grouping category, if combined with the data obtained, then the springs of Belo and Labat have different riparian tree species compositions. One of the factors thought to influence the difference in composition of riparian tree vegetation in the springs of Belo and Labat is land use.

4. Conclusion

Based on the data and the data analysis the following conclusios are drawn. *First*, riparian vegetation at the Belo and Labat springs has been degraded by high anthropogenic activity. But the quality of riparian vegetation in Belo (Naturalness = 4 and Hemeroby = 4) is still better than in Labat (Naturalness = 3, Hemeroby = 5).*Second*, wealth of riparian tree springs in Belo and Labat is low (R1 <3.5). However, the wealth of the Belo spring riparian tree species (R1 = 3.1) is still higher compared to Labat (R1 = 1.6).*Third*, diversity of riparian tree vegetation in Belo and Labat springs is low (H '= 0 - 2,302). The highest diversity index value is found in Belo's springs (H '= 1.83) compared to Labat (H' = 1.45).*The last*, the composition of riparian tree vegetation in the springs of Belo and Labat is not the same (SI = 42.05%). This is because the land use around the spring varies.

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